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STUDIES IN FRUIT DISEASES

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By

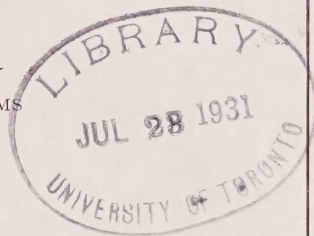
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FIRE BLIGHT OF PEARS AND APPLES

BY

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Fire blight is one of the more serious and costly diseases attacking pomaceous fruits on the North American continent. This is true, particularly with pears, as not only is much of the crop lost, but in addition, large limbs and sometimes entire trees are destroyed by its attack. With apples, the disease is largely confined to blossoms and young tender twigs and although occasionally serious losses occur, the trees are not so generally involved as is the case with pears. The disease also attacks quince.

Fire blight is widespread in occurrence, being found in practically all fruit growing districts of Canada and the United States. For many years, it was reported as occurring only on the North American continent but recently it has been observed in Japan, New Zealand and Italy. In America, the disease was first observed in the Hudson River Valley, New York State, about the year 1780. Since that time it has spread throughout the continent, although it was not until 1900 that it was reported in California and 1909 or 1910 in British Columbia. It has since become a disease of importance in these districts and has caused severe losses.

In Canada, ninety per cent of the pear crop is produced in Ontario and British Columbia. In both these provinces epidemics of fire blight have been experienced which resulted in the loss of many trees and threatened to seriously affect the industry by reducing the acreage and lessening interest in new plantings.

In Nova Scotia which produces approximately ten per cent of the pear crop of Canada, fire blight is as yet of no great importance. In the provinces of New Brunswick, Prince Edward Island and Quebec, pears are not grown commercially and the disease is reported as occurring only in isolated places in Quebec and Prince Edward Island.

In Ontario and British Columbia the disease constitutes a menace to the apple industry and it is reported to occur also in Quebec and New Brunswick.

THE DISEASE

The disease is generally known as fire blight although it is sometimes referred to as pear blight, blossom blight, twig blight, blight canker, sunscald and canker. The term "fire blight" seems most appropriate since diseased parts of trees, particularly the affected blossoms, leaves and twigs appear as if scorched by fire.

The disease, besides attacking pear, apple and quince, also occurs on crab-apple, hawthorn, mountain ash and a few related ornamentals. It is particularly severe on blossoms, twigs and limbs, is highly infectious and spreads rapidly if conditions are favourable.

Certain varieties of pears and apples are more susceptible to infection than others. Among pear varieties, Bartlett, Flemish Beauty, Clapp's Favourite and Duchess are considered highly susceptible while Kieffer, Seckel, Anjou and

Howell are more resistant. Of apples, Talman Sweet, Alexander, Greening, Baldwin, Transparent and Duchess stand out as the more susceptible varieties. Fameuse and MacIntosh have been reported to be quite severely attacked in Quebec.



FIG. 1.—Bartlett pear tree badly affected by fire blight. Note wilted condition of diseased twigs.

SYMPTOMS OF DISEASE

The most striking symptom of fire blight is a black colouration of affected twigs to which very often, dark brown to black dead leaves adhere (Fig. 1). Frequently this foliage clings to the twigs throughout the winter making them very conspicuous in contradistinction to healthy one which are devoid of leaves (Fig. 2).

When blossoms are affected, they become brown or black and are finally killed. The disease may pass from blossom to twig producing the characteristic symptoms mentioned above.

On young fruit, the inner tissues are at first soft and slimy but finally become hard, black, shrivelled and mummy-like. Such diseased fruit may remain on the tree for a long time.

On branches, limbs and trunk the disease is characterized by the formation of cankers (Fig. 3 a and b). These vary considerably in size, are brownish or purplish coloured, of water-soaked appearance and may have more or less definite margins. They are generally somewhat sunken, often cracked or blistered and frequently exude a gummy substance. If the activity of the canker has ceased, the extent of the diseased area is generally well marked by a distinct line of demarcation separating dead from healthy tissue. However, while the canker is active, the margin may be quite indefinite. When cut into, diseased bark will appear brown while healthy bark surrounding it will be pale green or creamy-white in colour.

With apples, the disease is more common as a blossom and twig blight, rather than in the form of limb, branch or trunk cankers. The reverse is true with pears. The reason that more body blight is found in pears may be due to the greater succulence of its bark.

THE CAUSE OF THE DISEASE

Fire blight is a bacterial disease caused by *Bacillus amylovorus* Burr. Trev. This is a very minute organism which invades living bark tissues where its growth causes the cankers already referred to. The bacteria live over winter along the margins of bark cankers on larger branches, limbs or trunks. When growth starts in the spring, the bacteria renew their activity and penetrate further into the tissues of the host. The gummy exudate mentioned above, consists almost entirely of these bacteria and constitutes a source of further infection.

METHODS OF INFECTION AND DEVELOPMENT OF DISEASE

(1) Blossom Blight.—This form of the disease is initiated and spread through the agencies of rain and flower-visiting insects. Splashing or wind-blown rain coming into contact with bacterial ooze becomes heavily contaminated with bacteria and may eventually reach the blossoms, causing infection.

Undoubtedly, all flower-visiting insects are important agents in spreading blossom blight. When these insects come in contact with bacterial ooze or visit blighted blossoms their bodies become contaminated and as a result may spread the disease to healthy blossoms in their search for nectar. From the blossoms, the disease may spread to the supporting twigs, producing the familiar twig blight.

(2) Twig Blight.—As just pointed out, this form of the disease often results from blossom infection but in addition the blight organism may enter directly through the leaves or tender growing tips and indirectly through punctures made by insects. The infection may progress readily down the twig and ultimately cause its death. Water sprouts and suckers because of their



FIG. 2.—Winter appearance of badly blighted Bartlett pear tree. Note clusters of leaves still adhering to the diseased twigs. (Photograph taken in February, 1931).

succulent growth are especially favourable to the entrance of disease germs and are often the means through which body blight cankers develop. Such cankers may develop into hold-over cankers which often girdle the trunk and result in death of the tree. The progress of infection in the twig is sometimes very rapid, the more succulent a twig, the more rapid the development provided warm, moist conditions prevail.

The important agents of spread of twig blight are sucking insects such as aphids and tree hoppers which initiate the disease as they migrate from diseased to healthy twigs in the course of feeding.

(3) Cankers (Body Blight).—Fully ninety per cent of the cankers result from the progress of the disease down twigs into supporting branches or trunk. Body blight cankers also result from infection through wounds caused by cultivators or other mechanical means. These cankered areas play a very important role in the life history of fire blight as they serve to harbour the bacteria from year to year, and are thus called hold-over cankers. The canker may become dry, crack and shrink away from the living bark and appear inactive yet the organism may remain alive at the margin and renew its activity the following season.

(4) Collar and Root Blight.—Diseased sprouts springing up from the base of the tree as well as infected basal wounds may result in collar and root blight. This phase of the disease is considered the most serious since the tree is either killed outright or so badly injured that it is no longer profitable.

INFLUENCE OF WEATHER

As long as warm, damp weather prevails, fire blight in its different forms is generally prevalent. Periods of relative high humidity directly favour development of the disease and indirectly induce a succulent growth of host tissues which, as already pointed out, is very susceptible to infection. On the other hand, during warm, dry weather, a harder, less succulent growth results with subsequent less infection.

INFLUENCE OF CULTIVATION

In the experience of many growers fire blight is more serious in pear orchards under cultivation than under sod. Cultivation of pear orchards may produce an abundance of succulent growth, which, as pointed out above, is very susceptible to fire blight. Where cultivation is practised, it is desirable that it should be so planned as to promote slow, uniform and normal growth. This type of growth is best obtained by early and thorough cultivation followed by sowing of cover crops.

Other factors of importance are pruning and fertilization. Pruning should be of the light corrective type so as to avoid the production of excessive tender shoots. The fertilizer requirements of the orchard should be carefully studied in order to provide sufficient fertility and yet not stimulate the rapid production of soft tissues which might readily blight.

METHOD OF CONTROL

Fire blight is not easy to control. The value of spraying as a preventive measure has not as yet been definitely established and the prompt, thorough removal of diseased parts remains the most practical method of control. The removal of diseased limbs and cankers may be done any time during the dormant or growing season. The preferable time is in the early winter months because at that time the margins are more definite and the cankered areas more easily



FIG. 3.—(A) Nature of fire blight canker on twig. Note shrunk diseased portion of twig and the definite line of demarcation between diseased and healthy wood. (B) Appearance of blight canker on a branch of pear tree. Note the canker has a definite margin and appears sunken.

detected and, therefore, it is easier to cut well below visible indications of diseased areas. In the growing season when the margins of cankers are less definite it is more difficult to be certain that the cut has been made a safe distance below infection. It is advisable, however, to make periodic examinations of orchards throughout the entire season to discover any diseased parts which may have been overlooked or may have developed since the last inspection.

The blight organism winters over at the margin of cankers on branches of one-half inch or more diameter as well as on larger limbs and trunks. It is important, therefore, to cut well beyond the visible boundary of cankers in order to be sure of eliminating all infection. The distance to cut below a cankered area varies with the age of the limb. On young wood, eight or ten inches below cankers is probably a safe margin, whereas on older limbs and branches four or five inches is usually sufficient. In cleaning out cankers it is necessary to cut four or five inches above and below and two to four inches on either side. If the cut surface shows any darkened areas in the wood it is necessary to cut further back until no discolouration is noticed. This is very important as it has been demonstrated that failure to cut a sufficient distance beyond the diseased area results in further progress of the disease. Cutting out of cankers on larger limbs is best accomplished by the use of the spoke-shave or farrier's knife.

All wounds should be disinfected with mercuric chloride. The disinfectant can be applied by means of a sponge or swab at the time the cut is made, or, as some growers prefer, the following day. The latter practice has the advantage of uninterrupted pruning operations. It is advisable also to disinfect pruning tools after each cut, especially if the operations are done during the growing season.

The most efficient disinfecting material is mercuric chloride.¹ This material can be purchased at most drug stores in convenient tablet form, one tablet to a pint of water giving the proper strength. The use of this material requires caution as it is *deadly poisonous* and must not be left standing where children or animals have access to it. The solution is also corrosive on metals and should be kept in non-metal containers.

It is advisable to destroy all prunings by burning since the causal organism is supposed to be capable of remaining alive for several weeks or even months in diseased wood.

The above recommendations for controlling fire blight have given very satisfactory results. In British Columbia, following the serious outbreaks of the disease during 1912-14, the Horticultural Branch of the Provincial Government has carried out rigid inspection of all pear and apple orchards for hold-over cankers. Where these are found the grower is notified that they must be cut out and burned before March 31. As a result, the disease is kept well under control and commercial loss of late years has been very slight.

As a supplementary control, pear and apple orchards should be gone over during early summer and all suckers removed and wounds disinfected. These growths are often the means of continuing the disease in active form late in the season and their removal from the standpoint of blight control is of great importance.

In addition, cultural practices such as late cultivation or the too generous use of fertilizers often cause an abundance of soft, succulent tissues and serves to increase the virulence of the disease as well as to perpetuate it into the late

¹ Note.—In certain states of the U.S.A. mercuric chloride is used in combination with cyanide of mercury for disinfecting purposes at the following strength:—

- 8 half gram tablets of mercuric chloride
- 8 half gram tablets of cyanide of mercury
- 1 pint of warm water
- 3 pints of commercial glycerine
- 2 packages of cardinal red dye (for colour)

The above mixture is used extensively in Michigan for disinfecting pruning wounds.

season. It is advisable, therefore, to avoid such practices and in preference, adopt such measures as will induce a moderate twig growth, if the best results are to be obtained.

In conclusion it may be stated that although the prevalence and severity of fire blight during recent years has been at a comparatively low level, the disease may become serious and destructive at any time and, therefore, requires on the part of the grower constant vigilance and attention to measures recommended for its control.

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